AD NUMBER

AD822832

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies only; Administrative/Operational Use; SEP 1963. Other requests shall be referred to U.S. Naval Oceanographic Office, Code 40, Washington, DC 20390.

AUTHORITY

USNOO notice, 25 Jan 1972

IR NO. M-4-63

INFORMAL REPORT

MARINE MAGNETIC PROFILES IN THE PACIFIC OCEAN 1961-1962

DEWEY R. BRACEY
Marine Branch
Magnetics Division
Hydrographic Surveys Department

SEPTEMBER 1963

NAVAL OCEANOGRAPHIC OFFICE
WASHINGTON, D. C. 20390

INFORMAL REPORT

The Informal Report (IR) as produced at the Naval Oceanographic Office is a means for personnel to issue timely scientific and technical preliminary reports of their investigations. These are primarily informal documents used to report preliminary findings or useful byproducts of investigations and work to members of the scientific and industrial communities.

Informal Reports are assigned sequential numbers for each calendar year; the digits preceding the dash indicate the year.

The distribution made of this report is determined primarily by the author. Information concerning obtaining additional copies or being placed on a distribution list for all future Informal Reports in a given area of interest or specialty field, should be obtained from:

Distribution Control Department
Code 4420
Naval Oceanographic Office
Washington, D. C. 20390

ABSTRACT

Marine magnetic data were collected along 25,824 nautical miles of survey track in the Pacific Ocean. These data, presented in profile form, reveal distinct zones of differing magnetic character defined by changes in the frequency and amplitude of magnetic anomalies. The data also provide evidence that a north-south magnetic lineation pattern exists in the northeast Pacific Ocean between 133° and 165° west longitude.

This report has been reviewed and is approved for release as an UNCLASSIFIED Informal Report.

H. P. STOCKARD
Director, Magnetics Division

CONTENTS

FIGURES

I. INTRODUCTION

During 1961 and 1962 marine magnetic information was collected along the tracks of the USS REHOBOTH (AGS-50) in the Pacific Ocean. This information was collected as part of the U. S. Naval Oceanographic Office Project 0-162. The overall purpose of this survey was the investigation of geomagnetic, oceanographic, and bathymetric properties in the Pacific Ocean.

This report presents and describes the 25,820 nautical miles of profiled magnetic information collected during this survey.

II. SURVEY OPERATIONS

A. Conduct of Survey

Survey tracks to and from various ports of call during the survey, such as San Francisco to Adak, were run parallel when possible. The average line spacing between these tracks is 30 miles.

Whenever possible, control was maintained by radar and visual fixes at one hour time intervals. Fix accuracy during these periods is estimated as being within one mile. On the survey tracks that are out of visual and radar range of land, ship's position was determined by Loran-A in areas of good reception, and by celestial fixes and dead reckoning outside these areas. Position accuracy is estimated at $\pm$10 miles along this portion of the tracks.

Average ship's speed while surveying was 12 knots.

B. Instrumentation

Total magnetic intensity measurements were made with a Varian marine proton precession magnetometer, model V-4931. The sensor unit for this magnetometer was contained in a cylinder 24 inches long and 6 inches in diameter. This sensor was towed 575 feet astern in order to reduce the effects of the ship's magnetic field.

Because of equipment design, magnetic data were recorded as "magnetometer counts," a unit of measurement inversely related to the magnetic field intensity. These units were recorded on a Varian model G-11A analog recorder and printed out in digital form on a Hewlett-Packard digital recorder, model 560-A.

III. DATA PROCESSING

The magnetic data from the analog tapes were scaled and converted from magnetometer counts to absolute values in gammas (1 gamma = 1×10^{-5} oersteds) by the use of a template. The data were then plotted in total intensity profile form. An average regional magnetic gradient was removed from these profiles by graphical methods. The resultant residual magnetic profiles were superimposed on the survey tracks plotted on a bathymetric contour chart. These profiles are shown in figures 1 through 3. The bathymetric contour charts are based on the H.O. 15,254 series.

No corrections were made to any of the magnetic data for temporal variations of the earth's magnetic field.

IV. SURVEY RESULTS

A. Northern Area

A total of approximately 10,624 nautical miles of profiled magnetic information along survey tracks was collected in this area. These profiles are shown in figure 1.

While presentation of magnetic profiles at a reduced scale limits the amount of detail that can be shown, it is compensated for by allowing the observer to recognize large regional trends and areas of differing magnetic character. This is particularly true of two or more parallel profiles of great length, where these trends can be traced from one track to another. The magnetic profiles from San Francisco to Adak, Alaska, are an example of this. Correlation of anomalies across these two profiles can be made along the length of the tracks, even though the tracks are an average of 30 miles apart. The magnetic features seem to be aligned in a north-south direction from a point near the Mendocino Escarpment all the way to 165° west longitude. In previous geomagnetic work done in the northeastern Pacific area (Mason, 1958; Mason and Raff, 1961; Raff and Mason, 1961), it has been shown that an extensive north-south oriented linear pattern of magnetic anomalies extends westward from the U. S. continent to approximately 135° west longitude. The information shown in figure 1 indicates that the lineations extend at least 1000 nautical miles farther west.

Zones of differing magnetic character can also be distinguished in the area. Going westward along the tracks there is first a zone

of relatively low amplitude, low frequency anomalies extending from near San Francisco to the Mendocino escarpment. Following this is a zone of high frequency anomalies extending out to about 133° west longitude. Beyond this zone is a region characterized by high amplitude, low frequency anomalies extending to approximately 160° west longitude. One of these anomalies (longitude 146° west; latitude 47°30' north) has a relief of 1200 gammas. This region is followed by a zone of very low frequency, low amplitude anomalies extending to the northern side of the Aleutian Trench.

In the Aleutian Islands, profiles crossing the Aleutian Ridge show very high amplitude anomalies. Those profiles paralleling the ridge have relatively low amplitudes. East of Ostrov Beringa in the western Aleutian chain there is a very pronounced positive anomaly with an amplitude exceeding 1250 gammas.

A series of broad, high amplitude positive and negative magnetic anomalies occur along the track that parallels the coast of Japan and the Kuriles. The width of these anomalies may be due to the angle at which the profile crosses the features. These anomalies are located near the junction of the Japan and Kurile Trenches southeast of Hokkaido, and on the outer or eastern side of the trenches.

These anomalies do not continue across the trench. The adjacent profile on the inner side of the trench shows relatively small magnetic features.

The magnetic profiles east of Honshu show positive anomalies of 100-200 gammas maximum over the Japan Trench. This is in contrast to those over the Aleutian Trench which have very low amplitudes.

B. North-Central and Equatorial Areas

Approximately 15,200 nautical miles of profiled magnetic information was collected in these two areas (figures 2 and 3). Except for breaks in the track caused by stopping for oceanographic stations, profiles in the North-Central and Equatorial Areas are essentially continuous. Because some of the magnetic features are also continuous from one area to another, the two areas will be discussed together.

In the region east of 157° west longitude and south of 25° north latitude, magnetic anomalies show a marked decrease in amplitude relative to the amplitudes of the other anomalies in the two areas. The one exception in this region are the anomalies near the Marquesas Islands. One of these anomalies has a relief of approximately 1350 gammas.

Between longitudes 140° and 147° west the two parallel profiles northeast of the Hawaiian Islands show a north-south orientation of anomalies similar to the orientation of anomalies in the Northern Area.

The profiles radiating from the Hawaiian Islands show a zone of very low amplitude anomalies extending out from the islands for several hundred nautical miles. Except for the profile east of the islands, the amplitudes of the anomalies become higher with increased distance from the islands.

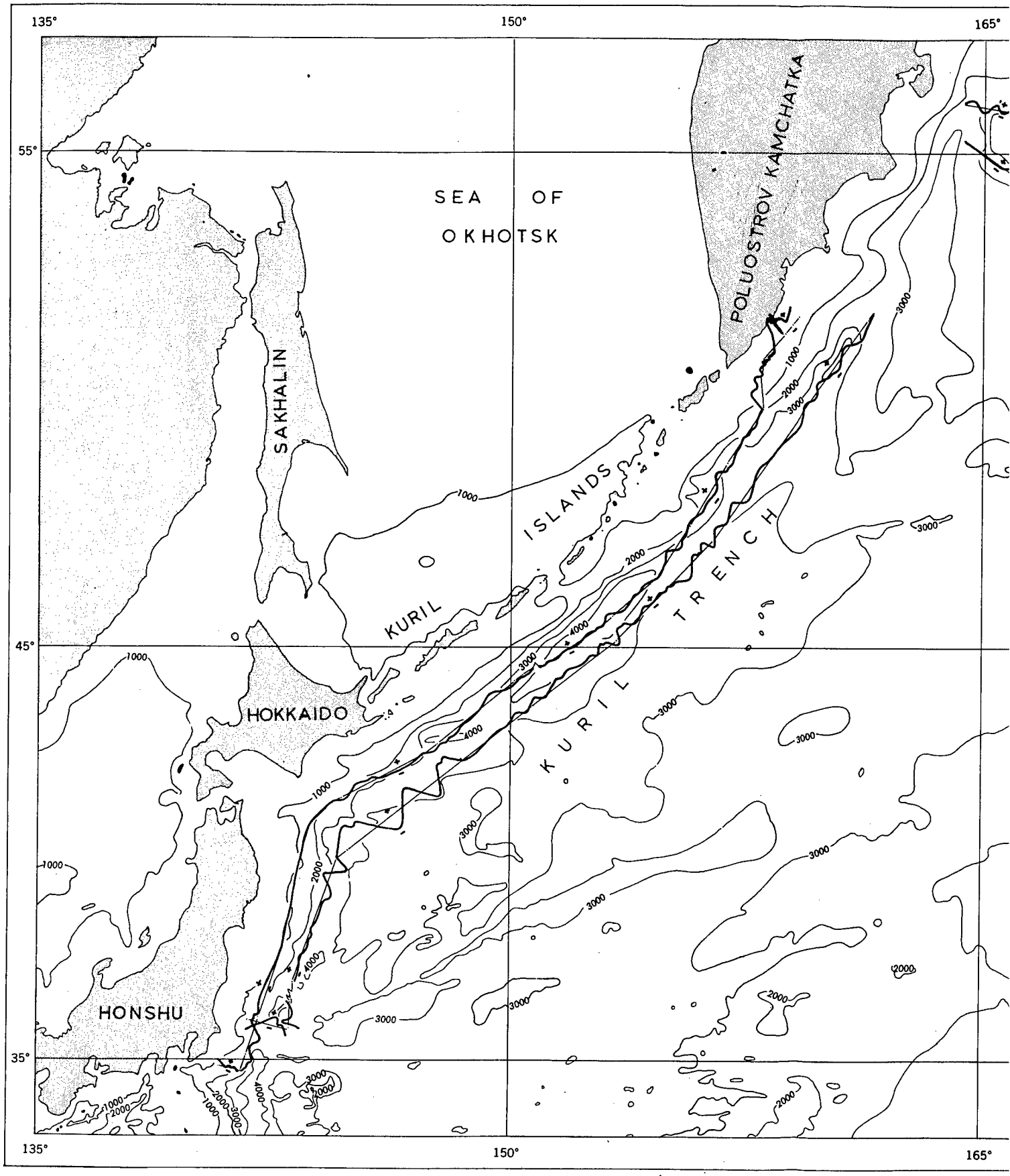
The profile crossing the Northwest Christmas Island Ridge shows high frequency anomalies directly over the ridge, with low frequency, high amplitude anomalies to the north and south of the ridge.

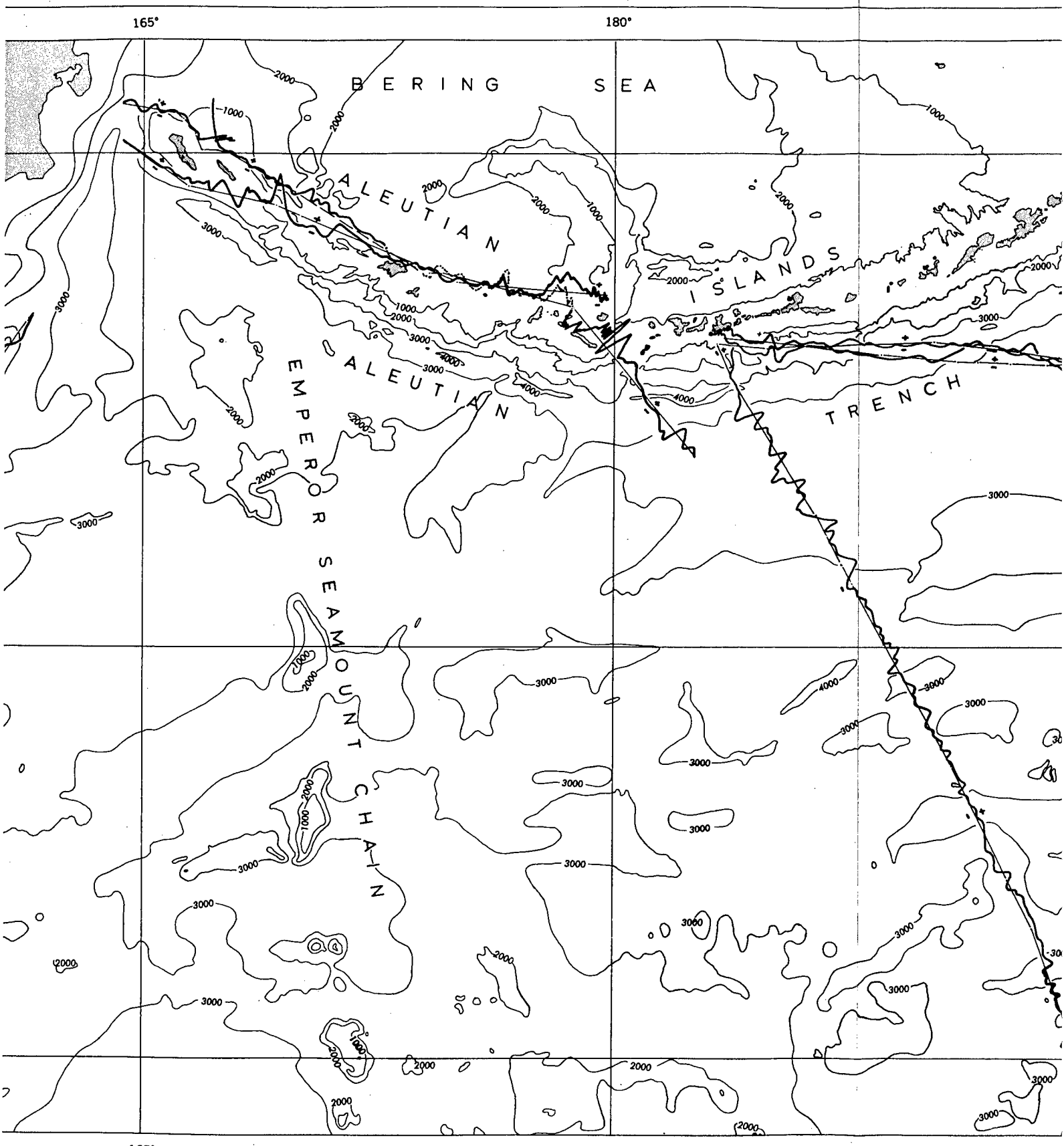
A very large anomaly occurs over the Marcus-Necker Ridge on the western-most profile. This anomaly has a relief of approximately 1200 gammas. Further south along this track the character of the magnetic anomalies changes from relatively high amplitude anomalies to low amplitude anomalies occurring over the area inside the 3000 fathom curve. South of the 3000 fathom curve the profiles show high amplitude, relatively low frequency anomalies of a remarkably similar appearance.

V. SUMMARY OF FINDINGS

Marine magnetic profiles in the northern Pacific Ocean reveal magnetic anomalies oriented in a north-south direction extending from approximately 133° west longitude to 165° west longitude. North of the Mendocino Escarpment these anomalies can be divided into zones consisting of anomalies with differing frequency and amplitude characteristics. This "zoning" of magnetic anomalies is also apparent in the North-Central and Equatorial Pacific areas. Southeast of 25° north latitude and 157° west longitude magnetic profiles show anomalies of low amplitudes relative to the amplitudes of anomalies on profiles outside this area.

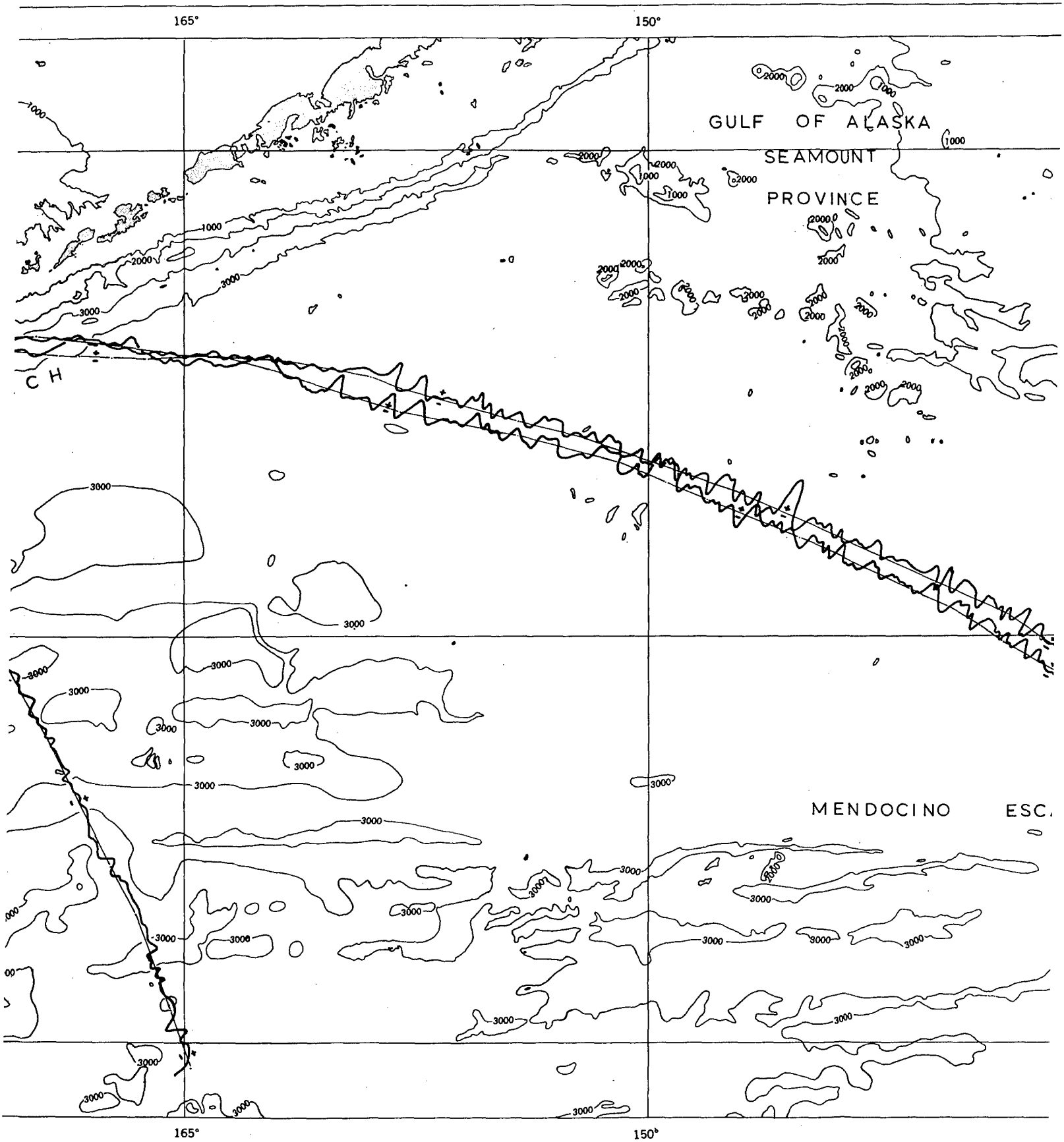
A series of high amplitude magnetic anomalies are present on the eastern side of the Kuril Trench near its junction with the Japan Trench. Magnetic profiles on the western side of the trench indicate that these anomalies do not continue across the trench.


135°
150°
165°
55°
45°
35°
SEA OF OKHOTSK
POLUOSTROV KAMCHATKA
SAKHALIN
KURIL ISLANDS
KURIL TRENCH
HOKKAIDO
HONSHU
1000
2000
3000
4000



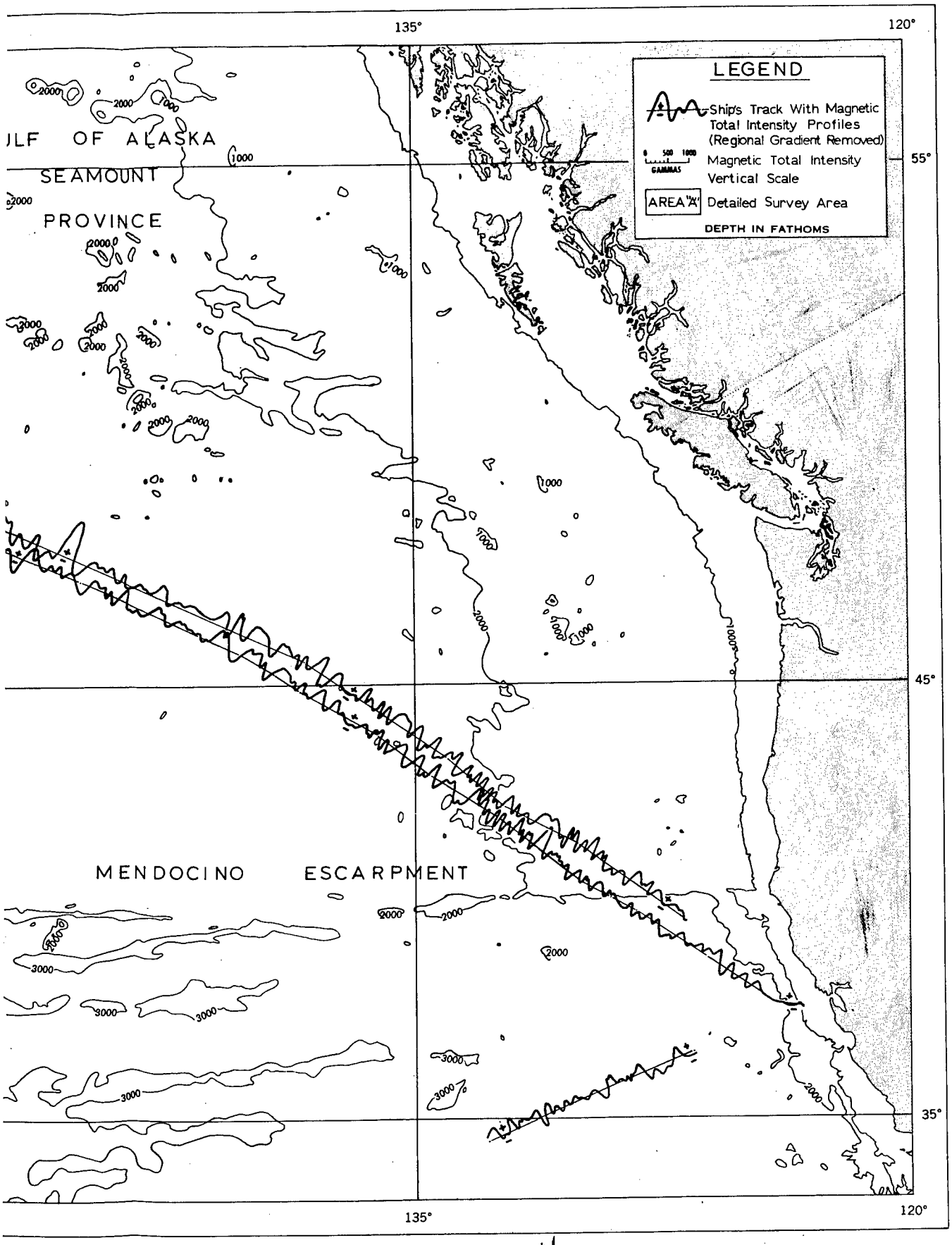
2

FIGURE 1.—MARINE MAGNETIC PROFILES IN THE PACIFIC O



3

E PACIFIC OCEAN—NORTHERN AREA


MERCATOR PROJECTION
135°
120°
55°
45°
35°
LEGEND
Ship's Track With Magnetic Total Intensity Profiles (Regional Gradient Removed)
0 500 1000 GAMMAS
Magnetic Total Intensity Vertical Scale
AREA "A"
Detailed Survey Area
DEPTH IN FATHOMS
JLF OF ALASKA
SEAMOUNT
PROVINCE
MENDOCINO ESCARPMENT
1000
2000
3000

4

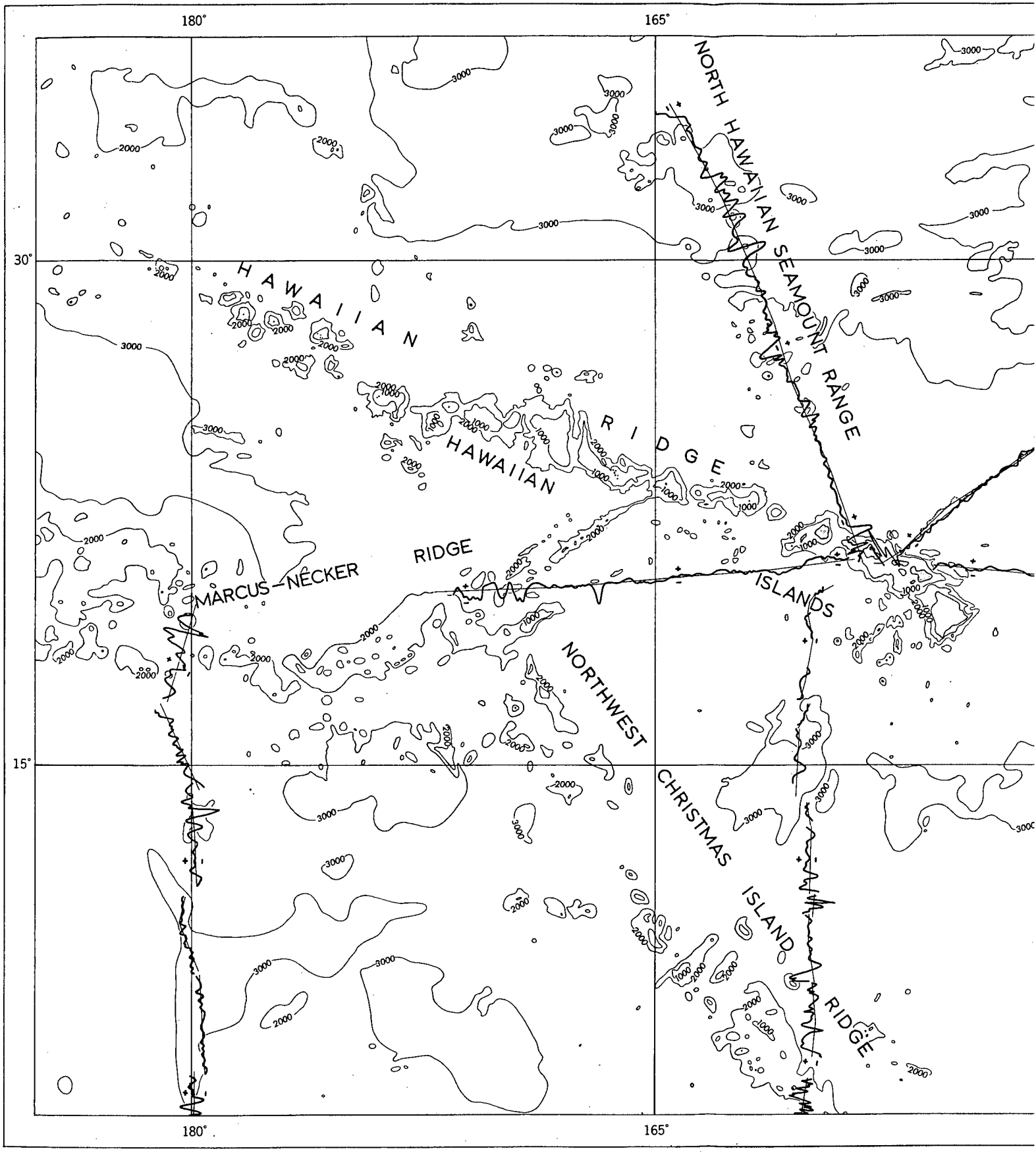
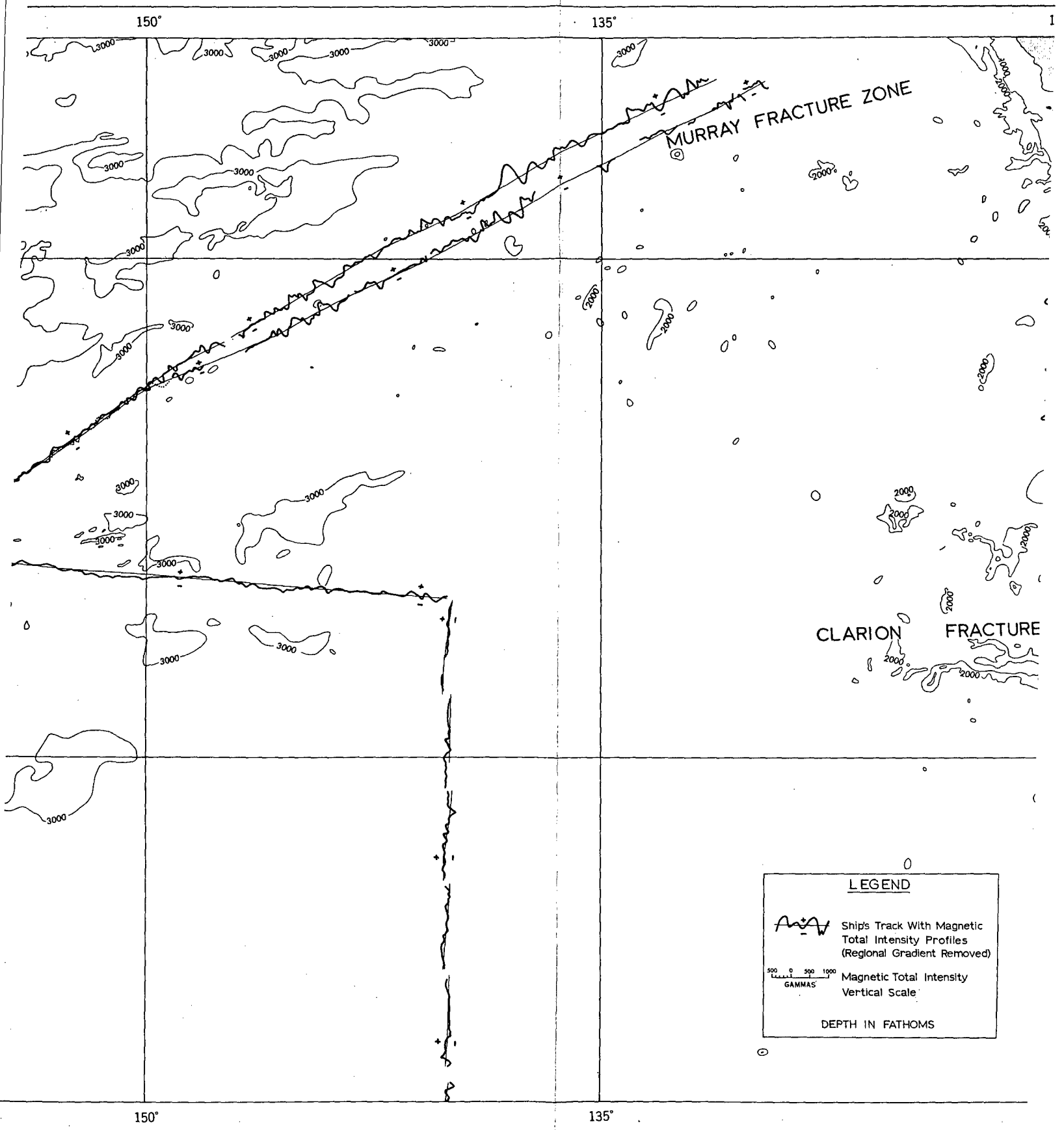
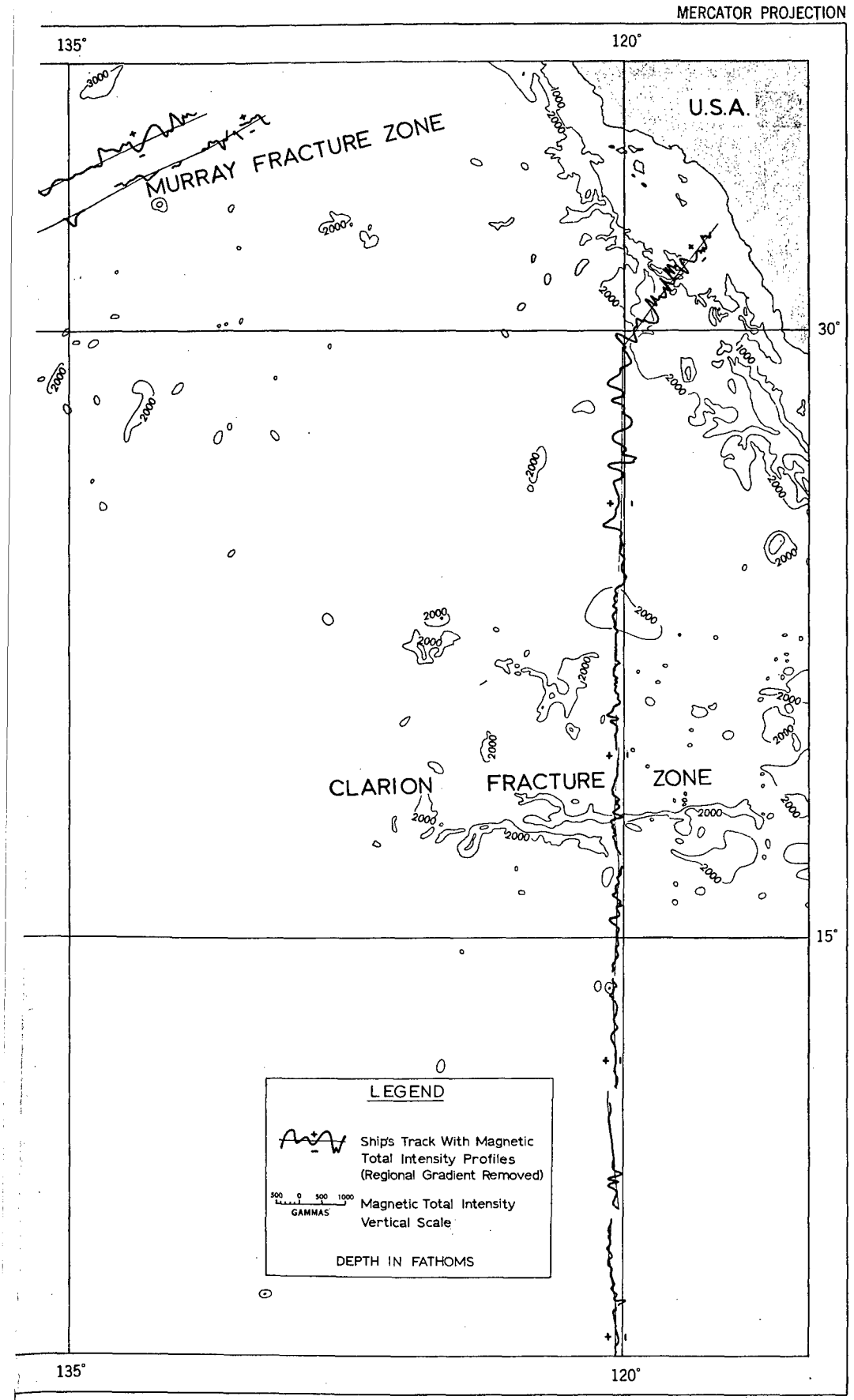


FIGURE 2.—MARINE MAGNETIC PROFILE



OFILES IN THE PACIFIC OCEAN—NORTH-CENTRAL AREA

2



3

-CENTRAL AREA

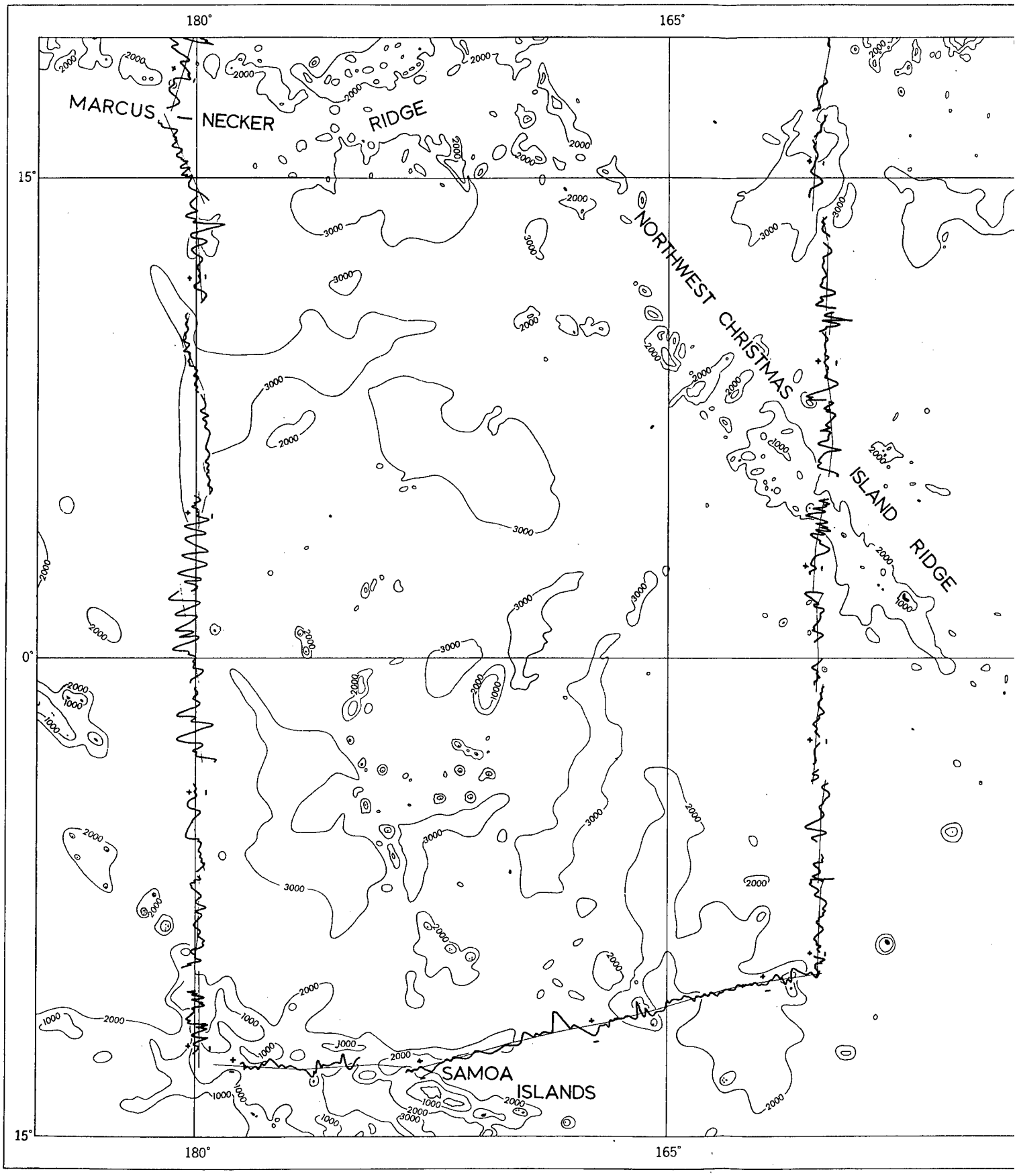
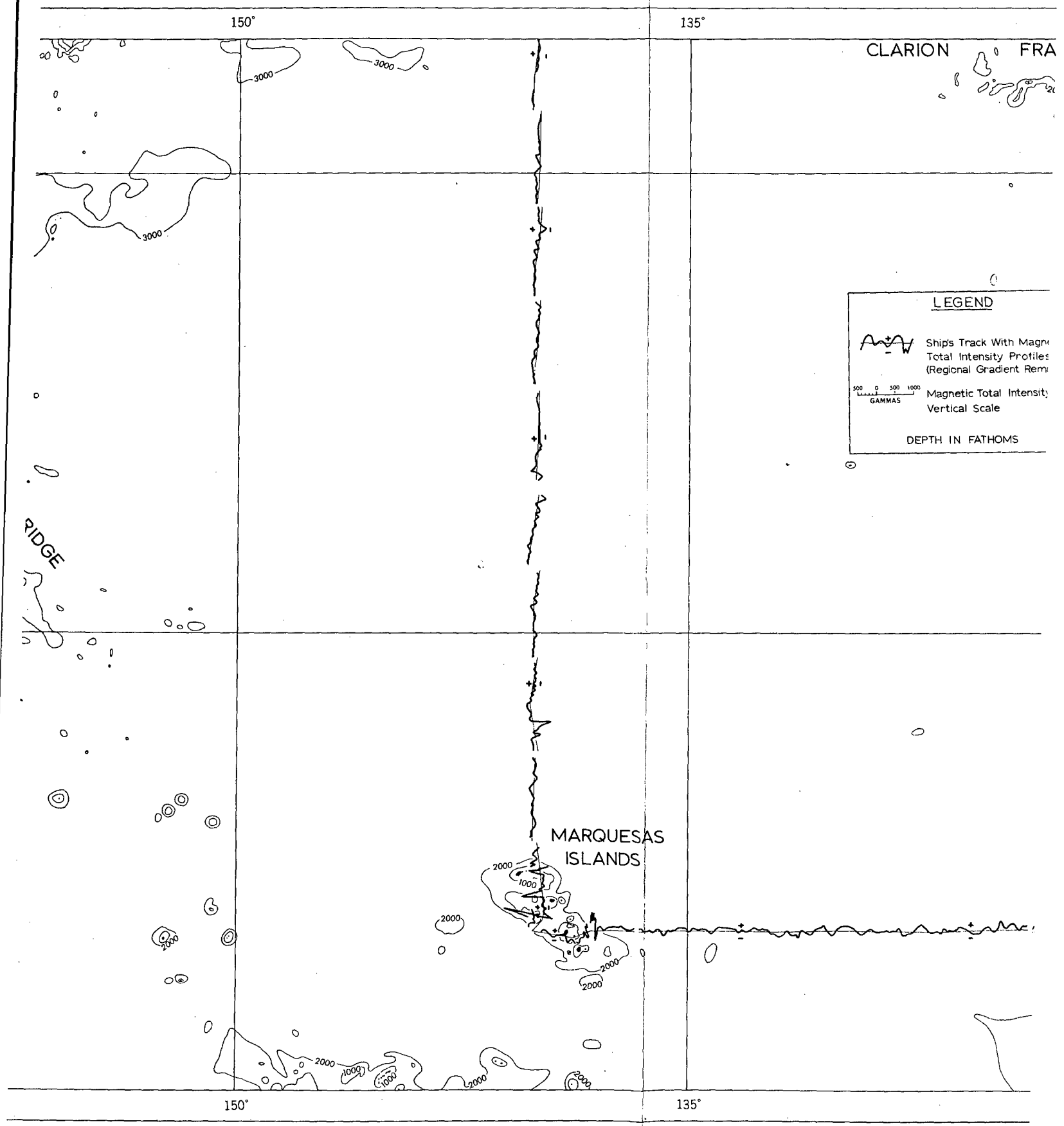
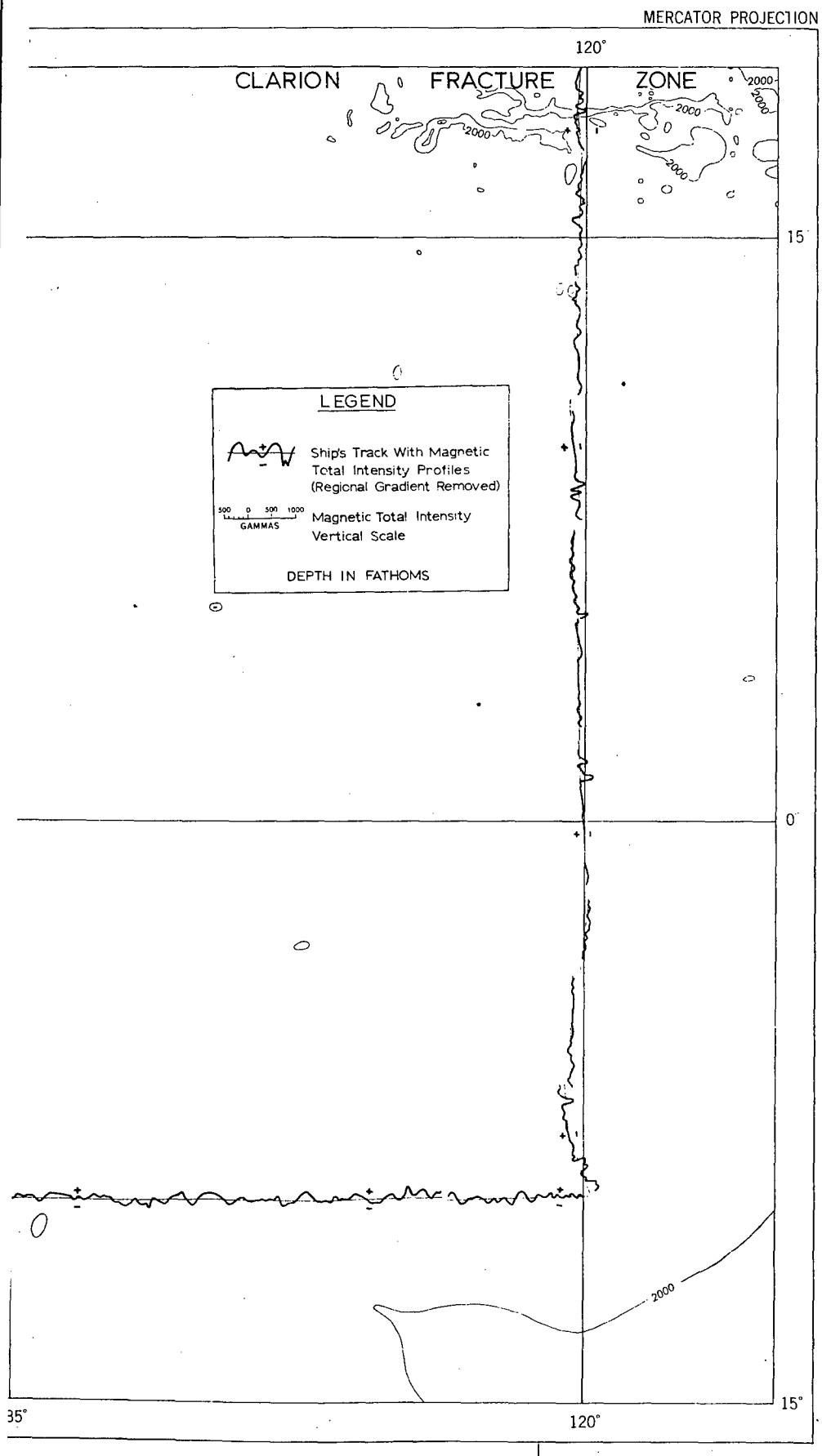


FIGURE 3.—MARINE MAGNETIC PROF



TIC PROFILES IN THE PACIFIC OCEAN—EQUATORIAL AREA

2


MERCATOR PROJECTION
120°
CLARION
FRACTURE
ZONE
2000
2000
2000
2000
2000
15°
LEGEND
Ship's Track With Magnetic Total Intensity Profiles (Regional Gradient Removed)
500 0 500 1000
GAMMAS
Magnetic Total Intensity Vertical Scale
DEPTH IN FATHOMS
0°
2000
15°
35°
120°

3

IAL AREA

REFERENCES

Mason, R. G., A Magnetic Survey Off The West Coast Of The United States, Geophysical Journal, v. 1, p. 320-329. 1958.

Mason, R. G., and Raff, A. D., Magnetic Survey Off The West Coast of North America, 32° N. Latitude to 42° N. Latitude, Geological Society of America Bulletin, v. 72, p. 1259-1266. 1961.

Raff, A. D., and Mason, R. G., Magnetic Survey Off The West Coast of North America, 40° N. Latitude to 52° N. Latitude, Geological Society of America Bulletin, v. 72, p. 1267-1270. 1961.

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
GEOMAGNETISM						
MAGNETIC SURVEYS						
PACIFIC OCEAN						

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*

U. S. Naval Oceanographic Office
Washington, D. C. 20390

2a. REPORT SECURITY CLASSIFICATION

UNCLASSIFIED

2b. GROUP

3. REPORT TITLE

MARINE MAGNETIC PROFILES IN THE PACIFIC OCEAN 1961-1962

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

5. AUTHOR(S) *(First name, middle initial, last name)*

Dewey R. Bracey

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
September 1963	10	3

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO.	IR NO. M-4-63
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*
d.	Formerly IMR M-4-63

10. DISTRIBUTION STATEMENT

Each transmittal of this document outside the agencies of the U. S. Government must have prior approval of the U. S. Naval Oceanographic Office (Code 40)

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	U. S. Naval Oceanographic Office Washington, D. C. 20390

13. ABSTRACT

Marine magnetic data were collected along 25,824 nautical miles of survey track in the Pacific Ocean. These data, presented in profile form, reveal distinct zones of differing magnetic character defined by changes in the frequency and amplitude of magnetic anomalies. The data also provide evidence that a north-south magnetic lineation pattern exists in the northeast Pacific Ocean between 133° and 165° west longitude.